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Application of IOT technology in providing population health during the Sars-Cov-2 pandemic

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Abstract *-This article discusses the possibilities of using smart solutions in order to increase the efficiency of the medical system. During the SARS-CoV-2 pandemic, the possibility of remote online monitoring of the health of patients with chronological disease will be considered in order to prevent them from becoming infected with the virus. The use of IoT technology in the organization of a medical system with this potential will be considered.*

Keywords: internet of things, telemedicine, coronavirus pandemic, population health, telecommunication.

INTRODUCTION

The field of medicine is more relevant than ever in today's pandemic era. It can be said that the whole of humanity is feeling it. In particular, with the growing number of people infected with COVID 19 in our country, there is a growing need to further improve the medical system of the country. The use of information and communication technologies in this area is one of the effective solutions to increase the efficiency of the medical system. The telemedicine system, which is formed as a result of the convergence of the medical system with telecommunication systems, is a manifestation of modern medicine, the introduction of which in our country will serve to raise the healthcare system of our country to a higher level. The use of IoT technology in order to increase the potential of telemedicine allows to achieve effective solutions.

During the SARS-CoV-2 coronavirus pandemic, which is of concern to all mankind, effective solutions are being sought to reduce the level of infection of the population with this virus.

It is known that this virus is more dangerous for people with various chronological co-morbidities. Below we will look at exactly what co-morbidities can lead to serious consequences of SARS-CoV-2 coronavirus infection. They are the following diseases[1]:

- Asthma and chronic lung disease;
- Diabetes mellitus;
- Serdechno-sosudistye zabolevaniya;
- Gipertonicheskaya bolezn;
- Oncological diseases.

Bronchial asthma is a chronic disease characterized by repeated attacks of breathlessness and wheezing. The frequency of attacks can vary from several times a day to several times a week.

According to WHO (World Health Organization) estimates, 235 million people worldwide suffer from asthma. It is also the most common chronic illness in children.

During an asthma attack, the mucous membrane of the bronchi swells, the airways spasm and narrow, which is why less air enters the lungs. It becomes difficult for asthmatics to inhale and especially exhale. The attacks are accompanied by coughing, wheezing, increased shortness of breath. The body tries its best to counteract them, and this struggle significantly weakens it. According to WHO estimates, 235 million people suffer from asthma.

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Asthma attacks can trigger allergens and respiratory tract infections. In this case, the immune system has to fight not only asthma, but also other diseases. Sometimes she is unable to cope with her task, and in the most unfavourable cases this can lead to irreversible consequences.

Diabetes. Diabetes occurs when the pancreas does not produce enough insulin, or when the body cannot use the insulin it produces efficiently. This leads to a chronic high blood sugar - hyperglycaemia.

There are two types of diabetes. The first type, also called insulin-dependent, is characterized by a lack of insulin production. Mostly children are exposed to it. Type 2 diabetes affects about 90 present of those who have the disease. It develops as a result of the body's inability to effectively use the insulin it produces.

Elevated blood sugar weakens the body's resistance. Infectious diseases, especially those with fever, can dramatically worsen the condition of diabetics - even those whose disease is well controlled with medication.

But with diabetes mellitus, not only carbohydrate metabolism is disturbed. The disease can affect blood vessels and affect the state of internal organs, subjecting them to additional stress. And then it becomes much more difficult for the immune system to protect the body from foreign and harmful interference.

Cardiovascular diseases. More people die each year from cardiovascular disease (CVD) than from any other disease. According to the WHO, in 2016 they caused the death of almost 18 million people, which is one third of all deaths in the world. In 85 percent, death was from a heart attack (heart attack) or stroke. CVDs include coronary artery disease, in which the blood vessels are unable to supply blood to the heart muscle, and disease of the vessels that supply blood to the brain.

Any infectious disease for people with similar problems can be fatal. The same applies to those who suffer from dysfunction of the heart valves: viral infections can destabilize the functioning of the entire body.

Hypertonic disease. Essential hypertension or hypertension characterized by high blood pressure is a widespread disease. The total number of hypertensive patients in the world is 1.13 billion people.

Hypertension is considered one of the leading causes of death on our planet. It also increases the risk of developing diseases of the cardiovascular system, brain and other diseases.

High blood pressure leads to damage to arterial vessels and affects the work of the heart, which is forced to be in a state of overload. This can lead to the development of severe cardiovascular diseases and, as a result, weaken the body's resistance to viruses and other infections.

Oncological diseases. The risk group also includes patients with cancer. Cancer is the second leading cause of death in the world. According to the WHO, 9.6 million people died from them in 2018.

One of the most common cancer treatments is chemotherapy. In this case, cytostatic are used - anticancer drugs that disrupt the growth, development and division of malignant cells. But cytostatic attack not only cancer cells - healthy tissues also suffer from them, this damages the immune system, and the body becomes more susceptible to pathogenic microorganisms.

In order to prevent the coronavirus SARS-CoV-2 from infecting the population with the above-mentioned chronological diseases, their health should be monitored remotely and online, and the necessary instructions should be provided on an ongoing basis. In order to be able to provide such remote medical services, it will be necessary to use IoT technologies in the medical system. It is IoT technology that allows you to remotely monitor customer health online and respond immediately to any changes in customer health and take the necessary action.

IoT technologies in medicine are used in several scenarios: in remote monitoring of patients, assistance in rehabilitation after a stroke, to achieve sports results, the study of internal organs, and tracking the safety of medicines. Wearable devices are mainly used in IoT medicine. The application of IoT technology in medicine provides the following opportunities:

- *Remote monitoring*. Remote health monitoring is the most explicit way to use IoT for health

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purposes. This approach allows the patient to reduce the costs of visiting physicians, who are always aware of the patient's current state of health and can promptly recommend a change in diet or stop taking certain medications. The work of medical professionals will be performed by miniature sensors and applications. Respiratory sensors can accurately determine the breathing rate. The tags transmit data to the smartphone. The mobile app can send notifications to take deep breaths in times of stress and provide tips to improve sleep quality.

- *Rehabilitation assistance*. Shirley Ryan Ability Lab flexible devices will help in the rehabilitation of stroke patients. If before round-the-clock monitoring of a patient's health was difficult to imagine without many wires, then with this solution he can lead a normal life in a domestic environment. Shirley Ryan Ability Lab devices are flexible and easy to stretch. They are attached to the skin of the throat to measure swallowing ability and speech patterns to treat speech disorders - aphasia. Conventional speech therapy instruments are not intelligent enough to make out the patient's voice and background noises. For hypertensive patients, Vodafone and the Swiss company Medisante have developed smart devices for measuring blood pressure in patients at home. These devices were commissioned by the European Society of Hypertension (Germany). The devices measure blood pressure and blood glucose levels, and then transmit the readings using a Vodafone SIM card to a special IoT platform. The information is then made available to patients and physicians [2].
- Study of internal organs. To study the state of internal organs, microscopic sensors were created, which were labeled into capsules. The sensors co-developed by Otsuka Pharmaceuticals and Proteus Digital Health in drugs work in conjunction with wearable devices. Through wireless channels, information will be transmitted from micro sensors in internal organs to wearable devices. After the pill reaches the stomach, the sensor sends a signal to the body patch, equipped with sensors and transmitting data to the patient's smartphone and the attending physician's device.

Methodology.

In this article, we want to offer solutions that allow remote monitoring of the health of patients with exactly the chronological disease listed above and appropriate response to changes in them. One of them is a solution to use IoT technologies in remote monitoring of the medical condition of patients with diabetes[3].

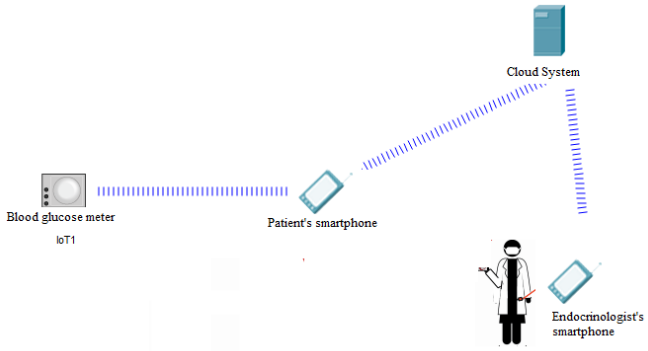


Fig.1. An online system for controlling the amount of glucose in a client's blood

With the help of this system, it is possible to monitor the level of glucose in the blood of the client by an endocrinologist who constantly treats. This eliminates the need for patients with this disease to see a doctor. This dramatically reduces the likelihood of SARS-CoV-2 coronavirus infection in these patients. As a result, it will serve to reduce the number of people infected with the virus and those who have suffered from it.

Conclusion

Someday (perhaps very soon), the body of a health-conscious person will be stuffed with various sensors that will measure the parameters of the body's work and, possibly, send them to a personal health-manager or attending physician. In the meantime, this technology is just beginning to develop. In order to reduce the level of population exposure during the SARS-CoV-2 coronavirus pandemic, it is necessary to develop the possibility of using IoT technology in

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remote control systems for other types of chronological diseases. This will further reduce the rate of virus infection in the population.

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